

**"1020.14 Temperature Control for Placement.** Temperature control for concrete placement shall conform to the following requirements:

- (a) *Temperature Control other than Structures.* The temperature of concrete immediately before placing, shall be not less than 10 °C (50 °F) nor more than 32 °C (90 °F). Aggregates and/or water shall be heated or cooled as necessary to produce concrete within these temperature limits.

When the temperature of the plastic concrete reaches 30 °C (85 °F), an approved retarding admixture shall be used or the approved water reducing admixture in use shall have its dosage increased by 50 percent over the dosage recommended on the Department's Approved List of Concrete Admixtures for the temperature experienced. The amount of retarding admixture to be used will be determined by the Engineer. This requirement may be waived by the Engineer when fly ash compensated mixtures are used.

Plastic concrete temperatures up to 35 °C (96 °F), as placed, may be permitted provided job site conditions permit placement and finishing without excessive use of water on and/or overworking of the surface. The occurrence within 24 hours of unusual surface distress shall be cause to revert to a maximum 32 °C (90 °F) plastic concrete temperature.

Concrete shall not be placed when the air temperature is below 5 °C (40 °F) and falling or below 2 °C (35 °F), without permission of the Engineer. When placing of concrete is authorized during cold weather, the Engineer may require the water and/or the aggregates to be heated to not less than 20 °C (70 °F) nor more than 65 °C (150 °F). The aggregates may be heated by either steam or dry heat prior to being placed in the mixer. The apparatus used shall heat the mass uniformly and shall be so arranged as to preclude the possible occurrence of overheated areas which might damage the materials. No frozen aggregates shall be used in the concrete.

For pavement patching, refer to Article 442.06(e) for additional information on temperature control for placement.

- (b) *Temperature Control for Structures.* The temperature of concrete as placed in the forms shall be not less than 10 °C (50 °F) nor more than 32 °C (90 °F). Aggregates and/or water shall be heated or cooled as necessary to produce concrete within these temperature limits. When insulated forms are used, the temperature of the concrete mixture shall not exceed 25 °C (80 °F). If the Engineer determines that heat of hydration might cause excessive temperatures in the concrete, the concrete shall be placed at a temperature between 10 °C (50 °F) and 15 °C (60 °F), per the Engineer's instructions. When concrete is placed in contact with previously placed concrete, the temperature of the concrete may be increased as required to offset anticipated heat loss.

Concrete shall not be placed when the air temperature is below 7 °C (45 °F) and falling or below 4 °C (40 °F), without permission of the Engineer. When placing of concrete is

authorized during cold weather, the Engineer may require the water and/or the aggregates to be heated to not less than 20 °C (70 °F) nor more than 65 °C (150 °F). The aggregates may be heated by either steam or dry heat prior to being placed in the mixer. The apparatus used shall heat the mass uniformly and shall be so arranged as to preclude the possible occurrence of overheated areas which might damage the materials. No frozen aggregates shall be used in the concrete.

When the temperature of the plastic concrete reaches 30 °C (85 °F), an approved retarding admixture shall be used or the approved water reducing admixture in use shall have its dosage increased by 50 percent over the dosage recommended on the Department's Approved List of Concrete Admixtures for the temperature experienced. The amount of retarding admixture to be used will be determined by the Engineer. This requirement may be waived by the Engineer when fly ash compensated mixtures are used.

- (c) Temperature. The concrete temperature shall be determined according to ASTM C 1064."

## **WEED CONTROL, PRE-EMERGENT GRANULAR HERBICIDE**

Description: This work shall consist of spreading a pre-emergent granular herbicide in areas as shown on the plans or as directed by the Engineer. This item will be used in mulched plant beds and mulch rings.

Materials: The pre-emergent granular herbicide (Snapshot 2.5 TG or equivalent) shall contain the chemicals Trifluralin 2% active ingredient and Isoxaben with 0.5% active ingredient. The herbicide label shall be submitted to the Engineer for approval at least seventy-two (72) hours prior to application.

Method: The pre-emergent granular herbicide shall be used in accordance with the manufacturer's directions on the package. The granules are to be applied prior to mulching.

Apply the granular herbicide using a drop or rotary-type designed to apply granular herbicide or insecticides. Calibrate application equipment to use according to manufacturer's directions. Check frequently to be sure equipment is working properly and distributing granules uniformly. Do not use spreaders that apply material in narrow concentrated bands. Avoid skips or overlaps as poor weed control or crop injury may occur. More uniform application may be achieved by spreading half of the required amount of product over the area and then applying the remaining half in swaths at right angles to the first. Apply the granular herbicide at the rate of 100 lbs/acre (112 kg/ha) or 2.3 lbs/1000 sq. ft. (0.01 kg/1000 sq. meters).

Method of Measurement: Pre-emergent granular herbicide will be measured in place in Pounds (Kilograms) of Pre-emergent Granular Herbicide applied. Areas treated after mulch placement shall not be measured for payment.

Basis of Payment: This work will be paid for at the contract unit price per pound (kilogram) of WEED CONTROL, PRE-EMERGENT GRANULAR HERBICIDE which price shall include all materials, equipment, and labor necessary to complete the work as specified.

## SODDING, SALT TOLERANT

All work, materials and equipment shall conform to Section 252 and 1081 of the Standard Specifications except as modified herein.

### Article 1081.03(b) Salt Tolerant Sod

Delete the following species:

Dawson Red Fescue	15% by Weight
Scaldis Hard Fescue	15% by Weight

Add the following species:

Audubon Red Fescue	15% by Weight
Rescue 911	15% by Weight

## SEEDING, CLASS 2A

All work, materials and equipment shall conform to Section 250 and 1081 of the Standard Specifications except as modified herein.

### Article 250.07 Seeding Mixtures – Table 1

#### **Class 2A – Salt Tolerant Roadside Mixture**

Delete the following species:

Dawsons Red Fescue

20 Kg/Hectare (30 Lb/Acre)

Scaldis Hard Fescue

20 Kg/Hectare (30 Lb/Acre)

Add the following species:

Audubon Red Fescue

20 Kg/Hectare (30 Lb/Acre)

Rescue 911

20 Kg/Hectare (30 Lb/Acre)

## ROADWAY CONSTRUCTION

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## **ROADWAY CONSTRUCTION SPECIAL PROVISIONS**

### **DEWATERING**

The Contractor will be required to provide dry soil conditions throughout the life of the project, including the construction of the water mains, force mains, storm sewers and subgrade along both 171<sup>st</sup> Street and Park Avenue. The groundwater has been estimated at an elevation of 610 (M.S.L.) along 171<sup>st</sup> Street and Park Avenue, and at an elevation of 613 throughout the detention pond limits. Dewatering shall be in accordance with the Temporary Dewatering Wells Specifications (Section 09999) of the Detention Pond Specifications section of this proposal.

### **DRIVEWAYS**

Driveways shall be constructed in accordance with the applicable portions of Sections 351, 406 and 423 of the Standard Specifications and the details shown in the plans. All driveways within the R.O.W. shall consist of PCC Driveway Pavement, 8". All proposed driveways beyond the R.O.W. shall consist of Aggregate Base Course, Type B, 10"; Bituminous Concrete Binder Course, Superpave, IL-19, N50, 2 ¼"; and Bituminous Concrete Surface Course, Superpave, Mix "C", N50, 1 ½".

Driveways shall be measured in accordance with the requirements of Articles 351.11, 406.24 and 423.02 of the Standard Specifications.

This work shall be paid for at the contract unit price per SQUARE YARD for PORTLAND CEMENT CONCRETE DRIVEWAY PAVEMENT, 8"; per SQUARE YARD for AGGREGATE BASE COURSE, TYPE B, 10"; per TON for BITUMINOUS CONCRETE BINDER COURSE, SUPERPAVE, IL-19, N50, and per TON for BITUMINOUS CONCRETE SURFACE COURSE, MIX "C", N50.

### **BITUMINOUS SURFACE REMOVAL (VARIABLE DEPTH)**

This item shall consist of constructing a butt joint and a satisfactory transition between pavement being replaced and pavement remaining in place in accordance with Article 440.03 of the Standard Specifications as modified herein. The Contractor shall saw to the minimum depth shown in the plans, the joint between pavement remaining and pavement being replaced, with a concrete saw. Bituminous surface shall be removed from 4 ¼" to 2" in depth to obtain the proposed profile as shown on the plans.

This work shall be done in such a manner that a straight joint will be secured.

The machine use for surface removal shall be a milling machine meeting the requirements of Article 440.03 of the Standard Specifications. Material resulting from the operation shall be removed and disposed of as specified in Article 440.06 of the Standard Specifications.

Should any pavement be damaged by the removal operations sufficient to warrant replacement, in the Engineer's judgment, the Contractor shall replace it in kind for no additional payment.

Surface removal shall be measured in place and the area computed in square yards. This work will be paid for at the contract unit prices per SQUARE YARD for BITUMINOUS SURFACE

REMOVAL (VARIABLE DEPTH), measured as specified herein and shall include the cost of required saw cut.

#### BITUMINOUS SHOULDER SUPERPAVE 6"

This work consists of furnishing, placing, and compacting bituminous shoulders 6" for guardrail stabilization in accordance with the applicable portions of Section 482 of the Standard Specifications and details shown in the plans.

The Contractor shall place and compact all material to the satisfaction of the Engineer. The aggregate used shall meet the gradation requirements of CA-10. The finished surface shall allow for proper surface drainage and be free of depressions.

In the event that guardrail exists or placed prior to the stabilization, there shall be no extra payment allowed to meet these requirements.

This work will be paid for at the contract unit price per SQUARE YARD of BITUMINOUS SHOULDER SUPERPAVE 6".

#### DUCTILE IRON FORCE MAIN, 24"

This work shall consist of the construction of sixteen-inch (24") ductile iron force main as indicated on the plans. The force main shall be "Ductile Iron," ANSI thickness Class 52, Clow "Super Bell-Tite", "Push-On" Joint, or approved equal, and must meet all applicable requirements of ANSI A21.51-1976 (AWWA C151-76), ANSI A21.11 (AWWA C111), and ANSI A21.4 (AWWA C104) specifications. Alloyed steel bolts shall be used to prevent corrosion.

Measurement shall be made along the centerline of force main installed. The cost of furnishing all labor, materials and equipment necessary for excavation, and construction of the new force main will be paid for at the contract unit price per FOOT for DUCTILE IRON FORCE MAIN, 24".

#### RESTRICTED DEPTH MANHOLES AND CATCH BASINS

This work shall be in accordance with Section 603 of the Standard Specifications except that this item requires a flat slab top (Standard 602601) in lieu of a conical section due to lack of clearance. The flat slab top will be provided at no additional cost and shall be included in the Contract unit price per EACH for RESTRICTED DEPTH MANHOLES or RESTRICTED DEPTH CATCH BASINS, of the type or type and diameter specified and with the type of frame and grate or frame and lid specified.

#### GRATED INLET, SPECIAL

This work shall be in accordance with Section 542 of the Standard Specifications except as modified herein. The grated inlet shall be constructed according to the details shown as shown on



the plans. Shop drawings shall be submitted by the Contractor and approved by the Engineer prior to construction of the grated inlet.

This work shall be paid for at the contract unit price per EACH for GRATED INLET, SPECIAL.

#### COMBINATION CONCRETE CURB & GUTTER, TYPE B-6.12 & B-6.24

This work shall be in accordance with Section 606 of the Standard Specifications except as modified herein. All proposed curb and gutter adjacent to proposed PCC pavement shall include epoxy coated tie bars. Tie bars shall be of the size and spacing as indicated in the CCHD plan details and as directed by the Engineer. Tie bars shall not be paid for separately, but shall be incidental to the cost of proposed combination concrete curb and gutter.

This work shall be paid at the contract unit price per FOOT for COMBINATION CONCRETE CURB AND GUTTER of the TYPE indicated.

#### COMBINATION CONCRETE CURB & GUTTER, TYPE B-6.12 & B-6.24, SPECIAL

This work shall be in accordance with Section 606 of the Standard Specifications except as modified herein. All curb and gutter shall be depressed according to State Standard No. 606001. All proposed curb and gutter adjacent to PCC pavement shall include epoxy coated tie bars. Tie bars shall be of the size and spacing as indicated in the plan details and as directed by the Engineer. Tie bars shall not be paid for separately, but shall be incidental to the cost of proposed combination concrete curb and gutter.

This work shall be paid at the contract unit price per FOOT for COMBINATION CONCRETE CURB AND GUTTER, SPECIAL of the TYPE indicated.

#### REINFORCING STEEL

This work shall be in accordance with the Cook County Highway Standard "Details and Notes for Construction of Pavement and Appurtenances" included in the plans. Reinforcement for concrete curb and gutter will not be paid for separately but shall be included in the contract unit cost per FOOT of COMBINATION CONCRETE CURB AND GUTTER of the size indicated on the plans. Pavement reinforcement, including dowel bars, will not be paid for separately but shall be included in the contract unit price per SQUARE YARD for PORTLAND CEMENT CONCRETE PAVEMENT 10" (JOINTED).

#### PROTECTIVE COAT

Protective Coat applications for concrete pavement, curb and gutter, and sidewalks shall be in accordance with Section 420.21 of the Standard Specifications. Protective Coat applications for all retaining walls shall be in accordance with Section 503.19 of the Standard Specifications. This work shall be paid for at the contract unit price per SQUARE YARD for PROTECTIVE COAT.

## FENCE REMOVAL

This work shall consist of removing existing fences of various types at locations specified on the plans, including any concrete post foundations, and disposing the fences at appropriate off-site locations. This work shall be paid at the contract unit price per FOOT for FENCE REMOVAL.

## CONCRETE STAIRS

This work shall be in accordance with the applicable portions of Section 424 and 503 of the Standard Specifications except as modified herein. The concrete stairs shall be constructed to the dimensions and elevations as shown in the plan details. The concrete thickness shall be a minimum of five inches (5"). The wire mesh shown on the plans shall be considered incidental to the cost of the concrete stairs. The stairs shall be backfilled with excavated sand.

This work shall be paid at the contract unit price per LUMP SUM for CONCRETE STAIRS, which shall be full compensation for all materials, labor and equipment required to complete the work.

## STORM SEWER (WATER MAIN REQUIREMENTS)

This work shall be in accordance with the applicable portions of Section 550 of the Standard Specifications except as modified herein. All pipe shall be Ductile Iron Pipe, Class 52 with Rubber Gasket joints at all locations as called out on the plans where proposed storm sewer crosses any water main to satisfy IEPA minimum clearance requirements.

This work shall be paid for at the contract unit price per FOOT for STORM SEWER (WATER MAIN REQUIREMENTS) of the diameter specified, which shall be full compensation for all materials, labor and equipment required to complete the work. Trench backfill will be paid for separately.

## IMPACT ATTENUATORS

This work shall be in accordance to the details included in the plans. All crash attenuators shall be "Quadguard Systems for Wide Hazards." The system shall be a 3-bay system with a concrete backup. The concrete pad shall be eliminated allowing only the construction of the below grade anchor block. The anchor bolts shall be tied directly into the proposed pavement. Design and installation information can be obtained from calling Energy Absorption Systems, Inc. at (888) 32-ENERG.

Materials shall meet the requirements of the impact attenuator manufacturer and the following:

Item	Article/Section
a) Fine Aggregate (Note 1) .....	1003.01
b) Steel Posts, Structural Shapes, and Plates.....	1006.04
c) Rail Elements, End Section Plates, and Splice Plates.....	1006.25
d) Bolts, Nuts, Washers and Hardware .....	1006.25
e) Hollow Structural Tubing .....	1006.27(b)
f) Wood Posts and Wood Blockouts .....	1007.01, 1007.02, 1007.06

g) Preservative Treatment .....	1007.12
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Note 1. Fine Aggregate shall be FA-1 or FA-2, Class A quality. The sand shall be unbagged and shall have a maximum moisture content of five percent.

Impact attenuators shall meet the testing criteria contained in the National Cooperative Highway Research Program (NCHRP) Report 350 for the test level specified and shall be on the Department's approved list. Fully redirective and partially redirective attenuators shall also be designed for bi-directional impacts.

This work shall be paid for at the contract unit price per EACH for IMPACT ATTENUATORS, which payment shall include the concrete below grade anchor block and anchor bolts and shall constitute full compensation for furnishing all labor, materials and equipment, complete, in place and accepted, and for all incidentals necessary to complete the work as shown on the plans and specified herein.

#### ELASTOMERIC CHECK VALVE, SERIES TF-2

This work shall be in accordance with Specification #RV-TF-2, Series TF-2 Slip-on Check Valves, or approved equal.

#### SERIES TF-2 SLIP-ON CHECK VALVES Specification #RV-TF-2

##### PART 1: GENERAL

##### 1.01 SUBMITTALS

- A. Submit product literature that includes information on the performance and operation of the valve, materials of construction, dimensions and weights, elastomer characteristics, flow data, headloss data, and pressure ratings.
- B. Upon request, provide shop drawings that clearly identify the valve dimensions.

##### 1.02 QUALITY ASSURANCE

- A. Manufacturer shall have at least ten (10) years experience in the production of elastomer "Duckbill" style elastomeric valves, and shall provide references and a list of installations upon request.
- B. Manufacturer shall have performed hydraulic tests on valves through 48" for flow capacity, headloss, and jet velocity at an accredited flow laboratory. Manufacturer shall provide test data upon request.
- C. Upon request, manufacturer shall provide installation data for existing valves of similar size and type to the project scope.

##### PART 2: PRODUCTS

##### 2.01 "DUCKBILL" ELASTOMERIC CHECK VALVES

- A. Check Valves are to be all rubber of the flow operated check type with a slip-on connection. The Check Valve is designed to slip over the specified pipe outside diameter and attached by means of vendor furnished stainless steel clamps. The port area shall contour down to a duckbill, which shall allow passage of flow in one direction while preventing reverse flow. The valve shall be one-piece rubber construction with nylon reinforcement. In sizes 20" and larger, the bill portion shall be thinner and more flexible than the valve body, and formed into a curve of 180°.
- B. Company name, plant location, valve size and serial number shall be bonded to the check valve. Elastomeric duckbill check valve shall be manufactured in the United States of America. A single manufacturer shall provide all elastomer duckbill check valves.

## 2.02 FUNCTION

- A. When line pressure inside the valve exceeds the backpressure outside the valve by a certain amount, the line pressure forces the bills of the valve open, allowing flow to pass. When backpressure exceeds the line pressure by at the same amount, the bills of the valve are forced closed.

## 2.03 MANUFACTURER

- A. All valves shall be of the Series TF-2 as manufactured by the Red Valve Co., Inc. of Carnegie, PA 15106 or approved equal.

## PART 3: EXECUTION

### 3.01 INSTALLATION

- A. Valve shall be installed in accordance with manufacturer's written Installation and Operation Manual and approved submittals.

### 3.02 MANUFACTURER'S CUSTOMER SERVICE

- A. Manufacturer's authorized representative shall be available for customer service during installation and start-up, and to train personnel in the operation, maintenance and troubleshooting of the valve.
- B. Manufacturer shall also make customer service available directly from the factory in addition to authorized representatives for assistance during installation and start-up, and to train personnel in the operation, maintenance and troubleshooting of the valve.

## PART 4: PAYMENT

- A. This work shall be paid for at the contract unit price per EACH for SERIES TF-2 ELASTOMERIC CHECK VALVE (SPECIAL), of the size specified on the plans, which payment shall include full compensation for furnishing labor, materials and equipment, complete, in place and accepted, and for all materials necessary to complete the work as shown on the plans and specified herein.

## ELASTOMERIC CHECK VALVE, SERIES TF-1

This work shall be in accordance with Specification #RV-TF-1, Series TF1 Slip-on Flat Bottom Check Valves, or approved equal. The specifications are the same as Series TF-2 Slip-on Check Valves except as follows:

### 2.01 "DUCKBILL" ELASTOMERIC CHECK VALVES

A. Check Valves are to be all rubber of the flow operated check type with a slip-on connection. The Check Valve is designed to slip over the specified pipe outside diameter and attached by means of vendor furnished stainless steel clamps. The port area shall contour down to a duckbill, which shall allow passage of flow in one direction while preventing reverse flow. The valve shall be one-piece rubber construction with nylon reinforcement. The duckbill shall be offset so that the bottom line of the valve is flat, keeping the invert of the pipe parallel with the invert of the valve. The top of the valve shall rise to form the duckbill shape. In sizes 20" and larger, the bill portion shall be thinner and more flexible than the valve body, and formed into a curve of 180°.

### PART 4: PAYMENT

A. This work shall be paid for at the contract unit price per EACH for SERIES TF-1 ELASTOMERIC CHECK VALVE (SPECIAL), of the size specified on the plans, which payment shall include full compensation for furnishing labor, materials and equipment, complete, in place and accepted, and for all materials necessary to complete the work as shown on the plans and specified herein.

## BOLLARDS

This work shall be in accordance with the detail as shown on the plans. The post shall be steel, schedule 40, painted with yellow enamel, and filled with concrete. The Class SI Concrete foundation shall be included in the cost of the bollard. This work shall be paid for at the contract unit price per EACH for BOLLARDS, which payment shall include full compensation for furnishing labor, materials and equipment, complete, in place and accepted, and for all materials necessary to complete the work as shown on the plans and specified herein.

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## RETAINING WALL SPECIAL PROVISIONS

### HANDRAILS

This work shall be done in accordance with the details shown on the plans and as specified herein. The handrail assembly shall be fabricated and installed as shown to meet or exceed OSHA requirements. The Contractor shall submit three samples of handrail and post intersection indicating welded connection and finish along with the Manufacturer's catalog and product data. The Contractor shall field verify the locations of all posts prior to fabrication of pipe handrails and posts. Handrails shall be delivered to the site protected in polyethylene tubing with a minimum wall thickness of 0.05 inches. The tubing will be removed only after construction has been completed and as directed by the Engineer.

Fabricate aluminum handrails and posts of 1-1/2-inch Schedule 40 aluminum pipe conforming to ASTM B 241, 6063-T6. The handrails shall be finished with a NAAMM Architectural Class I AA-A41 clear natural coating. Pipe cuts shall be clean, straight, square and accurate for minimum joint gap. Work shall be done in conformance with the handrail manufacturer's instruction. Work shall be free from blemishes, defects, and misfits of any type which can affect durability, strength, or appearance. Grind exposed joints flush and smooth with adjacent finish surfaces. Make exposed joints such that they are butt tight, flush and hairline. Ease exposed edges to small uniform radius. Where practical, make bends in pipe without the use of fittings. Aluminum handrail components shall have a clear satin anodized architectural Class I finish of minimum 0.7 mil thickness.

Aluminum posts shall be anchored in Class SI Concrete foundations as shown on the details. These foundations will not be paid for separately, but shall be included in the cost of handrails.

This work shall be paid for at the contract unit price per FOOT for HANDRAILS, which payment shall include full compensation for furnishing labor, materials and equipment, complete, in place and accepted, and for all materials necessary to complete the work as shown on the plans and specified herein.

### LEVELING PAD FOR BLOCK RETAINING WALL BLOCK RETAINING WALL DRAINAGE FILL

All work shall be in accordance with the attached Modular Concrete Retaining Wall specifications following the retaining wall special provisions section except where supplemented by the details on the plans and these special provisions contained herein. The block retaining wall is located along the west side of Park Avenue from Sta. 21+70 to Sta. 22+27.

Sections 1.01 B. and 1.02 E. of the Modular Concrete Retaining Wall specifications shall not apply to this contract since the wall has been fully designed and shall be constructed as shown on the plans. Any material requirements, specifications or references pertaining to geogrid shall not apply to this contract.

The leveling pad shall be measured for payment in feet in place and paid for per FOOT for LEVELING PAD FOR BLOCK RETAINING WALL.

The retaining wall shall be measured for payment by measuring the vertical projection of the (front) face of the wall in place and shall be paid for per SQUARE FOOT for BLOCK RETAINING WALL.

This work shall be measured for payment in place and paid for per TON for DRAINAGE FILL.

## RETAINING WALL REMOVAL

The existing retaining walls located thru the underpass structures at the edge of pavement shall be removed according to Section 501 of the Standard Specifications except as modified herein. This work shall not be paid for separately, but shall be included in the contract unit cost per FOOT for CURB REMOVAL.

## CONCRETE RE-FACING

The Contractor's attention is called to the typical retaining wall sections for the gravity retaining wall along the curb line piers and the panel-strut retaining wall along the centerline piers. Portions of the existing concrete footings now below grade will be permanently exposed due to the lowering of the roadway profile and will thus require re-facing (refinishing).

Prior to constructing the aforementioned retaining walls the existing concrete that will be permanently exposed shall be pressure washed to remove all soil, debris and loose concrete in accordance with the applicable articles of Section 592 of the Standard Specifications. The subsequent re-finishing shall be performed concurrently with the finishing of the newly constructed retaining walls above the areas to be re-finished in accordance with Article 503.16 (a) of the Standard Specifications so as to prevent a visible delineation between the new concrete and the refinished concrete.

All work, including all material, labor and equipment necessary will be paid for at the contract unit price per SQUARE FOOT for CONCRETE RE-FACING. Washing of the bridge pier footings will not be paid for separately but shall be considered as included in the unit price bid for the concrete re-facing.

## RUSTICATION FINISH FOR RETAINING WALLS

This item consists of providing a rustication finish for retaining walls, abutments and pier as specified in the plans and in accordance with the details shown in the plans and the Special Provisions.

The forms shall be constructed so that the completed concrete structures conform to the shape, lines and dimensions of the members as shown on the Plans. The forms shall be properly braced or tied together to maintain position and shape. Forms shall be made sufficiently tight to prevent leakage of mortar.

Formliners shall be used to obtain the rustication finish. The formwork used shall have the strength and stability to ensure finished concrete dimensions within the tolerances specified below. The quality of the formwork shall be maintained throughout the entire project.

Variation in dimensions for the wall sections of the retaining wall, pier and abutments with a rustication finish shall be within the following tolerances: the width and depth of rustication joints shall be within 1/8" +; the location of the rustication joints shall be within 1/2" +; the maximum variation of a joint from a straight line shall be 1/4" + in 10 feet.

The Contractor shall also submit his/her proposed construction procedure for the rustication of the outside face of the retaining walls, abutments and pier. The Contractor's method of obtaining the surface texture specified on the Plans shall be subject to approval by the Engineer.

Upon approval of the construction method by the Engineer, the Contractor shall pour a 30'-0" long test section of retaining wall at the location directed by the Engineer. After removal of the formwork, the Engineer will examine the test section of the wall and instruct the Contractor if the rustication finish is acceptable or if future sections need further modifications. If necessary, the Contractor shall pour additional test sections of wall at locations designated by the Engineer until a wall section meets with the Engineer's approval. The rustication finish of all subsequently installed wall sections, abutments and pier shall match the approved test section. All deviations from



the approved rustication finish shall be repaired by the Contractor to the satisfaction of the Engineer at no additional cost to the County.

*The Contractor shall notify the Engineer at least 40 hours prior to placing concrete.*

Concrete shall not be placed until the Engineer has inspected the formwork and the placement of reinforcing bars for compliance with the plans.

METHOD OF MEASUREMENT: Rustication finish will be measured in place and the area computed in square feet. The dimensions used to compute the area rustication will be those dimensions indicated on the plan or directed by the Engineer which outline plane area. Measurement will not be on actual surface area of rustication finish.

BASIS OF PAYMENT: This work will be paid for at the Contact unit price per square foot for RUSTICATION FINISH.

## **MODULAR CONCRETE RETAINING WALL**

### **PART 1: GENERAL**

#### **1.01 Description**

- A. This work shall consist of furnishing and construction of a KEYSTONE Retaining Wall System or equal in accordance with these specifications and in reasonably close conformity with these specifications and with the lines, grades, design, and dimensions shown on the plans.
- B. Construction drawings and design calculations for the retaining wall system shall be prepared by a registered professional engineer and shall bear his signature and seal. The contractor shall submit the construction drawings and design calculations to the engineer for approval prior to beginning construction.

#### **1.02 Certification**

- A. Contractor shall submit a Manufacturers certification, prior to start of work, that the retaining wall system components meet the requirements of this specification.
  - i) The contractor's submittal package shall include but not limited to actual test results for tension/creep, durability/aging, construction damage, geogrid/facing connection, pullout, and quality control.
- B. Contractor shall submit certification, prior to start of work, that the retaining wall system (modular concrete units and specific geogrid):
  - ii) has been successfully utilized on a minimum of five (5) similar projects, i.e., height, soil fill types, erection tolerances, etc.; and
  - ii) has been successfully installed on a minimum of 1 million (1,000,000) square feet of retaining walls.
- C. Contractor shall submit a list of previous projects totaling of 500,000 square feet or more where the specific retaining wall system has been used successfully. Contact names and telephone numbers shall be listed for each project.
- D. Contractor shall submit a test report documenting strength of specific modular concrete unit and geogrid reinforcement connection. The maximum design tensile load of the geogrid shall be equal to the laboratory tested ultimate strength of geogrid / facing unit connection at a maximum normal force limited by the "Hinge Height" of the structure divided by a safety factor of 1.5. The connection strength evaluation shall be performed in accordance with NCMA test method SRWU-1.
- E. Contractor shall submit engineering plans prepared by a professional engineer experienced with Mechanically Stabilized Earth retaining wall systems and registered in the state of the project location. The engineering designs, techniques, and material evaluations shall be in accordance with the KEYSTONE Design Manual, 1994, NCMA Design Guidelines For Segmental Retaining Walls, 1993 or the AASHTO Standard Specifications for Highway Bridges, Section 5.8, 1993 Interim, whichever is applicable.

## **PART 2: PRODUCTS**

### **2.01 Definitions**

- A. Structural Geogrid - a structural element formed by a regular network of integrally connected tensile elements with apertures of sufficient size to allow interlocking with surrounding soil, rock, or earth and function primarily as reinforcement.
- B. Modular Unit - a concrete retaining wall element machine made from portland cement, water, and aggregates.
- C. Unit Fill - drainage aggregate which is placed within and immediately behind the modular concrete units.
- D. Reinforced Backfill - compacted soil which is placed within the reinforced soil volume as outlined on the plans.

### **2.02 Modular Concrete Retaining Wall Units**

- A. Modular concrete units shall conform to the following architectural requirements:

face color - standard manufacturers' color or custom color as specified by the Owner.

face finish - sculptured rock face in angular multiplaner configuration. Other face finishes will not be allowed without written approval of owner.

bond configuration - running with bonds nominally located at midpoint vertically adjacent units, in both straight and curved alignments.

exposed surfaces of units shall be free of chips, cracks or other imperfections when viewed from a distance of 10 feet under diffused lighting.

- B. Modular concrete units shall conform to the following material requirements:

1. Cement - Materials shall conform to the following applicable specifications.

- a. Portland Cement - ASTM C 150
- b. Modified Portland Cement - Portland cement conforming to ASTM C 150, modified as follows. Limestone - calcium carbonate, with a minimum 85 % content, may be added to the cement, provided these requirements of C 150 as modified are met; (1) limitation on insoluble residue 1.5 %; (2)

limitation on air content of mortar - volume percent, 22% maximum; and  
(3) limitations of loss of ignition - 7 %

- c. Blended Cements - ASTM C 618
  - d. Pozzolans - ASTM C 618
  - e. Blast Furnace Slag Cement - ASTM C 989
2. Aggregates - aggregates shall conform to the following specifications, as applicable.
- a. Normal Weight Aggregates - ASTM C 33
  - b. Lightweight Aggregates - ASTM C 331
3. Other Constituents - Air entraining agents, coloring pigments, integral water repellents, finely ground silica, and other constituents shall be previously established as suitable for use in modular concrete retaining wall units and shall conform to applicable ASTM standards or, shall be shown by test or experience to be not detrimental to the durability of the modular concrete units or any material customarily used in retaining wall construction.
- C. Modular concrete units shall conform to the following structural and geometric requirements:
- compressive strength = 3000 psi minimum;
- absorption = 8 % maximum (6% in northern states) for standard weight aggregates;
- unit depth - 20 inches minimum;
- unit width to height ratio = 2.25:1;
- unit weight - 90 lbs/unit minimum for standard weight aggregates
- inter-unit shear strength - 1500 pit minimum at 2 psi normal pressure;
- geogrid/unit peak connection strength - 1000 plf minimum at 2 psi normal force
- maximum horizontal gap between erected units shall be - 1/2 inch.

- D. Modular concrete units shall conform to the following constructability requirements:

vertical setback =  $1/8"$  + per course (near vertical) or 1 " per course per the design drawings;  
alignment and grid positioning mechanism - fiberglass pins, two per unit minimum;

### 2.03 Shear Connectors

- A. Strength of shear connectors between vertical adjacent units shall be applicable over a design temperature of 10 degrees F to + 100 degrees F. Shear connectors shall be 1/2 inch diameter thermoset isophthalic polyester resin-pultruded fiberglass reinforcement rods. Connectors shall have a minimum flexural strength of 128,000 psi and short beam shear of 6,400 psi.
- B. Shear connectors shall be capable of holding the geogrid in the proper design position during grid pre-tensioning and backfilling.

### 2.04 Base Leveling Pad Material

- A. Material shall consist of a compacted crushed stone base or non-reinforced concrete as shown on the construction drawings. The leveling pad shall be a minimum of 6 inches thick. As an option, concrete may be 3 inches thick with a compacted granular base for a total thickness of 6 inches.

### 2.05 Unit Fill

- A. Unit fill shall consist of clean 1" minus crushed stone or crushed gravel meeting the gradation listed below.

<u>Sieve Size</u>	<u>Percent Passing</u>
1 inch	100
3/4 inch	75-100
No. 4	0 - 10
No. 50	0 - 5

- B. One cubic foot, minimum, of drain fill shall be used for each square foot of wall face. Drain fill shall be placed within cores of, between, and behind units to meet this requirement.

### 2.06 Reinforced Backfill

- A. Reinforced backfill shall be free of debris and meet the following gradation requirements:

<u>Sieve Size</u>	<u>Percent Passing</u>
2 inch	100-75
3/4 inch	100-75

No. 4	100-20
No. 40	0-60
No. 200	0-35

Plasticity Index (PI) <10 and liquid limit <40.

- B. The maximum aggregate size shall be limited to 3/4 inch unless field tests have been or will be performed to evaluate potential strength reductions to the geogrid design due to damage during construction.
- C. Material can be site excavated soils where the above requirements can be met. Unsuitable soils for backfill (high plastic clays or organic soils) shall not be used in the backfill or in the reinforced soil mass.
- D. Contractor shall submit reinforced fill sample and laboratory test results to the Architect/Engineer for approval prior to the use of any proposed reinforced fill material.

## 2.07 Geogrid

- A. Ta, Allowable Tensile Design Load, shall be determined as follows:  
 $T_a = T_{cr} / (FD * FC * FS)$   
Ta shall be evaluated based on a 75 year design life.
- B. Tcr, Creep Limited Tensile Load  
Tcr shall be determined from 10,000 hour creep testing performed in accordance with ASTM D5262.
- C. FD, Factor for Durability/Aging  
FD shall be determined from polymer specific durability testing covering the range of expected soil environments.
- D. FC, Factor for Construction Damage  
FC shall be determined from product specific construction damage testing performed in accordance with GRI-GG4. Test results shall be provided for each product to be used with project specific or more severe soil type.
- E. FS, Overall Factor of Safety  
FS shall be 1.5 unless otherwise noted.
- F. The maximum design tensile load of the geogrid shall not exceed the laboratory tested ultimate strength of the geogrid/facing unit connection as limited by the "Hinge Height" divided by a factor of safety of 1.5. The connection strength testing and computation procedures shall be in accordance with NCMA test methods.
- G. Soil Interaction Coefficient, Ci  
Ci values shall be determined per GRI:GGS at a maximum 0.75 inch displacement.
- H. Manufacturing Quality Control

The geogrid manufacturer shall have a manufacturing quality control

program that includes QC testing for each 40,000 SF of production, each lot, or each production day. The QC testing shall include:

Tensile Modulus  
Specific Gravity  
Melt Flow Index (PP&HDPE)  
Molecular Weight (PETP)

### **PART 3      EXECUTION**

#### **3.01    Excavation**

- A. Contractor shall excavate to the lines and grades shown on the construction drawings. Architect/Engineer will inspect the excavation and approve prior to placement of leveling material or fill soils.
- B. Over-excavation of deleterious soils and replacement with suitable fill will be paid at unit cost rates.

#### **3.02    Base Leveling Pad**

- A. Leveling pad material(s) shall be placed to the lines and grades shown on the construction drawings, to a minimum thickness of 6 inches.
- B. Soil leveling pad materials shall be compacted to a minimum of 95 % standard or 90 % modified Proctor.
- C. Leveling pad shall be prepared to insure full contact to the base surface of the concrete units.

#### **3.03    KEYSTONE Unit Installation**

- A. First course of units shall be placed on the leveling pad, and alignment and level checked. Pins or molded surfaces of modular concrete units shall be used for alignment control.
- B. Position vertically adjacent modular concrete units as recommended by the Manufacturer.
- C. Maximum stacked vertical height of wall units, prior to wall drain fill and backfill placement and compaction, shall not exceed two courses.
- D. Whole, or cut, units on curves and corners to shall be erected with running bond approximately centered on units above and below.
- E. Cap units shall be glued to underlaying units with an adhesive recommended by the manufacturer.

#### **3.04    Structural Geogrid Installation**

- A. Geogrid shall be oriented with the highest strength axis perpendicular to the wall alignment.
- B. Geogrid reinforcement shall be placed at the elevations and to the extent

shown on the construction drawings or as directed by the Engineer.

- C. The geogrid shall be laid horizontally on compacted backfill. Place the next course of modular concrete units over geogrid. The geogrid shall be pulled taut, and anchored prior to backfill placement on the geogrid.
- D. Geogrid reinforcements shall be continuous throughout their embedment lengths. Spliced connections between shorter pieces of geogrid is not allowed unless pre-approved by the Architect/Engineer prior to construction.

### **3.05 Reinforced Backfill Placement**

- A. Reinforced backfill shall be placed, spread, and compacted in such a manner that minimizes the development of slack in the geogrid.
- B. Reinforced backfill shall be placed and compacted in lifts not to exceed 8 inches where hand compaction is used, or 12 inches where heavy compaction equipment is used.
- C. Reinforced backfill shall be compacted to 95 % of the maximum density as determined by ASTM D695. The moisture content of the backfill material prior to and during compaction shall be uniformly distributed throughout each layer and shall be within 2 percentage points dry of optimum.
- D. Only lightweight hand-operated equipment shall be allowed within 3 feet from the tail of the modular concrete unit.
- E. Tracked construction equipment shall not be operated directly upon the geogrid reinforcement. A minimum fill thickness of 6 inches is required prior to operation of tracked vehicles over the geogrid. Tracked vehicle turning should be kept to a minimum to prevent tracks from displacing the fill and damaging the geogrid.
- F. Rubber tired equipment may pass over geogrid reinforcement at slow speeds, less than 10 MPH. Sudden braking and sharp turning shall be avoided.
- G. At the end of each day's operation, the Contractor shall slope the last lift of reinforced backfill away from the wall units to direct runoff away from wall face. The Contractor shall not allow surface runoff from adjacent areas to enter the wall construction site.

## **PART 4 MEASUREMENT AND PAYMENT**

This work shall be paid for at the contract unit price per SQAURE FOOT for BLOCK RETAINING WALL, which payment shall include full compensation for furnishing labor, materials and equipment, complete, in place and accepted, and for all materials necessary to complete the work as shown on the plans and specified herein.